

Education for Sustainable Development: The Impact of an Out-door Program on Student Teachers

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ABSTRACT *The study used an outdoor program for promoting Education for Sustainable Development (ESD) in primary education and investigated the extent to which primary student teachers were prepared to deal with ESD. It also investigated the impact of an outdoor program on primary student teachers' knowledge and attitudes towards sustainable issues, and on their personal responsibility and willingness to be involved in ESD. The present study was part of a larger multifaceted project that attempted to provide an example for training primary student teachers in Education for Sustainable Development (ESD). Fifteen primary student teachers from a university participated in a training program. The program was based on an open-air photo exhibition titled "The earth from above" that focused on issues of sustainable development. Individual interviews were conducted with the participants, at the end of the program, for data collection. Evidence from the interview analysis indicates that student teachers' involvement in the project provided them with specific teaching strategies, and increased their competence and self-efficacy to be involved in ESD. The program also offered them the opportunity to identify the interconnections of environmental issues, and their social, economic and political dimensions. Student teachers realized through their active participation in the planning and teaching process how crucial is their role in cultivating environmentally literate citizens.*

KEY WORDS: *Education for sustainable development, higher education, outdoor learning, training program*

Introduction

The complexity of environmental issues and the worldwide recognition that they constitute social, economic, and political problems contribute to the foundation of Sustainable Development (SD) as the cornerstone for confronting the environmental degradation and provide guidelines for sustainable ways of living. There also exists a consensus that "education is the driving force for the change needed" (UNESCO, 2004, p. 49) and that Education for Sustainable Development (ESD) should be infused to all educational levels as a mean for a "systemic understanding of the relation between learning, society, and sustainability" (Sterling, 2002, p. 29).

The interconnected issues of globalisation, poverty alleviation, social justice, democracy, human rights, peace, and environmental protection require inclusive partnerships to create a global learning environment. Education should be the vehicle that will help learners to reconnect with the reality of their world and redesign their actions in order to correspond to the critical challenges of Sustaina-

ble Development (Macy & Brown, 1998; UNESCO, 2001). Education should adopt new learning models where environmental issues are not examined through a narrow and linear dimension restricted to specific disciplinary areas, but on the basis of a cross-curricular investigation that will bring together skills, knowledge, ethics, and values in a balanced way, so that the needs of a sustainable society are better addressed. ESD recognising that human actions have complex ecological consequences seems to be an alternative educational model for confronting environmental crisis, because it "promotes explanation and understanding of sustainability and encourages students into active engagement with sustainability issues in order to promote life styles that are compatible with sustainability and the equitable use of resources" (Benn, 1999, p. 6).

Environmental literacy, as a central concept of ESD, is translated to an active citizenship for a sustainable civil society and demands from educational systems to rethink their current educational practices, which have been characterized by managerialist, materialist, exploitative, and techno-rationalism (Sterling, 2001; Smith 2002). Higher Education (HE) institutions can play an important role for implementing ESD, due to their ability to influence their students and prospective teachers by cultivating appropriate habits of thought and action (Benn, 1999; Huckle & Sterling, 1996). Many international declarations acknowledged that HE has a special responsibility in addressing the challenges and opportunities for sustainable development, and stress that ESD should permeate the whole curriculum and programs of HE (ACU, 1993; IAU, 1993; UNESCO, 2001). Special emphasis is put on teacher training programs that will prepare future teachers for promoting effectively ESD in lower educational levels (pre-primary, primary, and secondary education levels). Various declarations argued that special emphasis should be given to the reorientation of teacher training programs as the focal point for promoting environmental literacy in society (COPERNICUS, 1993; MIO—ECSD, 1998). It seems necessary to align HE programs, and particularly the teacher preparation programs, with the main principles of ESD. Universities and education departments modulate the workforce and prepare people who will take a leading role in various domains of society. In particular, promoting ESD in educational departments is a matter of special interest, considering that students as future teachers will have the responsibility for infusing in school life initiatives such as ESD. Integration of ESD in lower levels of education also implies that teachers should be accordingly prepared, so that they feel inspired and confident to integrate innovative methodologies in their instruction (Lane, Wilke, Champeau, & Shivek, 1995).

Ali-Kahn (1991) designated professional development, personal environmental literacy, and environmental competence as the three key elements for reforming educational programs towards ESD. This also implies enhancing social awareness of future teachers, improving their competence through various educational activities, empowering their active involvement in the planning of appropriate learning procedures, pedagogical approaches, and methods oriented towards sustainable development (Benn, 1999; Powers, 2004). Personal participation, instructor credibility, intentionality, functionality, and self-efficacy constitute the main criteria for upgrading HE teacher-training programmes (Van Petegem, Blicck, & Van Hout, 2005).

Remarkable activities have been undertaken in various universities to incorpo-

rate the concept of sustainability in their programs, so that students' understanding of sustainability evolves with their understanding of their discipline (Second Nature, 1999; Institute of Environmental Studies, 1999; University of Technology-Sydney, 2000). A range of characteristics necessary for supporting sustainability in HE were also identified regarding policy formation, research, information, and programs (Jucker, 2002; Wals & Jickling, 2002; Heck, 2005).

Despite these important efforts for Sustainable Development (SD), educational departments have not been actively involved in incorporating ESD into their teacher education programs." Particularly, educational departments have not been actively involved in incorporating ESD into their teacher education programs (Gabriel, 1996; Hopkins, 2002). For example, research results indicate that ESD is restricted to short introductory-level programs and is considered as an isolated project, apart from prospective teachers' main education, and restricted mostly to environmental science programs (Haigh, 2005; Heck, 2005; Van Petegem et al., 2005). There is also evidence indicating that prospective teachers do not feel competent to be involved in ESD, and are not motivated and committed to act in the direction of sustainability, because they are not educated or trained properly for ESD (Mckewon, 2000; Powers, 2004; Van Petegem et al., 2005). Moreover, student teachers' knowledge for the environment and environmental issues is limited, and restricted in topics of geography and biology (Kaplowitz & Levine, 2005). International experiences related to infusing ESD in teacher education indicate that extensive research and in-depth discussion among different stakeholders are needed in order to investigate the aspects of ESD that should be infused in teacher education programs, so that sustainability content, concepts, methods, and approaches are successfully integrated into all disciplines.

ESD in Cyprus is in an early stage regarding its implementation at various educational levels. Limited initiatives have been undertaken for introducing ESD in primary and secondary education, but these attempts were rather fragmented, not continuous, and not coordinated. These efforts indicate however that Cyprus is moving forward to considering ESD as a priority for its' educational system. Specifically, Cyprus has adopted the UN Strategy for "Education for Sustainable Development: 2005-2015" (UNESCO, 2004) and several efforts have been directed towards the elaboration of a National Action Plan for "Environmental Education and Education for sustainable Development" (MEC, 2005). The main directions of the National Action Plan target the integration of ESD in the official education system through central actions, encouraging the adoption of the main dimensions of ESD. The plan is aligned to "Creating environmentally literate citizens, promoting pedagogical approaches and teaching methods for implementing ESD in school life, connecting formal with non-formal education, and encouraging community action for creating sustainable societies" (MEC, 2005, pp. 7-9).

These efforts should be also extended in Higher Education Institutions, where limited attention is officially directed towards ESD. For example, isolated programs, such as, "Natural Sciences in the Elementary School: Environment and living organisms" and "Environmental Issues" (University of Cyprus, 2006) dealing mainly with ecology and biology do not seem to promote ESD. In these programs, only few non-specialised modules include the environmental dimension. In other programs, ESD is not a real concern, and these efforts are not driven by unani-

mously accepted principles and seem to be rather marginalized. Nevertheless, the problem of ESD in higher education is not so much a problem in education, but a real problem of education (Orr, 1992). Universities should not treat sustainable issues as academic subjects, something external to the learner (Haigh, 2005), but they should pursue the greening of the curriculum, through cross-curricular programs and diverse pedagogical approaches that will lead to a holistic investigation of environmental issues.

Within this framework, the present study describes a specific attempt that was planned and implemented at the Educational Department, University of Cyprus, for preparing a small number of prospective primary school teachers to work for sustainable development with their students. Particularly, the study investigated student teachers' previous experiences and education in environmental issues, and examined the impact of an out-door program on their knowledge in sustainable issues. The study also investigated to what extent student teachers' involvement in the program contributed towards their empowerment for working with ESD as future teachers, and enhanced their personal responsibility for protecting the environment.

Methodology

Sample

Fifteen students from the Educational Department, University of Cyprus, were involved in this program. The participants were fourth-year students who were involved in their compulsory teaching practice in schools. Fifteen students out of a group of 45 students enrolled in a methods course volunteered to participate in the program as an additional and alternative requirement of their course. The other 30 students selected different, but similar activities to be involved in. The program was related to an open-air photo exhibition that was hosted in two central pedestrian zones of a city, for a period of approximately three months. The open-air photo exhibition of the photographer Yann Arthus-Bertrand, titled "the earth from above,"¹ consisted of 122 photos that was hosted in approximately 70 countries worldwide, and more than sixty million people attended it.

The main themes of these 122 photos deal with poverty, overpopulation, war and peace, lack of water, elimination of flora and fauna, consumerism, extinction of natural resources, social discriminations, the gap between the third world countries and the developing countries, the human activities that contribute to environmental degradation, and examples of sustainable living. All the photos were accompanied by comments and information of the issue presented by each of them.

Student Teacher Training Program

Student teachers' training lasted two months and was divided into three discrete phases. The first phase constituted the introductory stage where the students

1. www.yannarthusbertrand.org

were introduced to the concept of sustainable development and clarified various relevant issues. The systemic character of the environment was clearly articulated and the global dimensions of environmental issues were fully described and discussed. During this phase, students and their mentor discussed the sequential development of the program (its different phases, time limits, designation of working groups etc.), and the degree of their involvement in the planning and implementation of the program. Students were divided in three working groups (five persons in each group). Initially, working groups were guided to the photo exhibition in order to be familiarized with the exhibition, the issues depicted by the photos and their important messages in terms of fostering environmental awareness. Students took notes about any photos they considered more interesting. They were also encouraged to revisit the photo exhibition, and try to focus their attention on a sample of photos that could be used for further examination and study. After a brief discussion, the main criteria for selecting a photo were unanimously spelled out.

Thus, it was decided to include only a small number of photos, but these photos should deal with as many environmental issues as possible (sustainable issues, human interventions and their consequences, ways of sustainable living etc.). The photos should also connect global issues with national and local conditions, be motivating for primary school children, reveal the systemic character of the environment, indicate the interconnections of environmental issues, be appropriate for the design of learning activities, and present sustainable ways of living.

This process resulted in the selection of 17 photos based on over-population, destruction of cultural monuments, sustainable tourism, over fishing, uncontrolled use of sub aerial water, waste, use of chemical substances, sustainable production, human discriminations, poverty, sustainable management of natural resources, and renewable resources of energy. Three of these photos related to Cyprus emphasizing sustainable tourism, local products, and local culture.

During the second phase, student groups worked independently to design learning activities for primary school children. These activities should be consistent with the issues presented in the 17 photos, and conducive to cooperative learning (role play, discussion, problem-solving approach). The activities should also promote inquiry and encourage children involvement and creativity. Activities were flexible and could be tailored to children's age, their interest, prior knowledge and experience. An indicative sample of these activities is presented in Table 1.

The third phase included the teaching intervention that lasted four weeks. During this period, 475 fifth- and sixth-grade children from twelve primary schools, divided into groups of 20-30 students, visited the open-air exhibition. Five groups of children were assigned to each group of student teachers. Student teachers guided the groups in the open-air exhibition, "the earth from above," and involved them in specific activities, as those in Table 1. These activities followed constructivist principles, were organized every day from Monday to Friday, and lasted four hours a day for a whole period of four weeks. Initially, student teachers investigated using different approaches (questionnaires, interviews, and brainstorming) children's initial conceptions about the environmental issues that were presented in the selected set of photos. Then, each group of children studied and examined in depth a number of these environmental issues. Student teachers guided chil-

Table 1
Learning Activities Implemented in the Program

Themes of activities	Task	Pedagogical Method	Educational Techniques	Material	Duration
Environmental issues: Do we know what are they?	Children familiarization with environmental concepts and realising their interconnections	Discussion	Brainstorming Concept map	Big installed map Small photos labels with problems	40 minutes
Meeting the problems through photos	Get informed about the environmental issues and their global character through a guiding to the photo exhibition	Discussion Observations	Questioning Inquiring Analysis	Photos Worksheets	90 minutes
Environmental issues: Caution and consequences	Localization of a problem and indication of its cautions and its consequences	Teamwork Discussion	Simulation Game Concept Map	Map Cards Photos Rope	50 minutes
Investigating a specific problem: Inquiring sustainable solutions	Empower children's critical thinking, cultivate a sense of personal responsibility through inquiring alternative solutions for confronting environmental issues and establishing a sustainable way of living	Teamwork Discussion	Role play Problem solving approach	Cards Photos Work sheets Articles	60 minutes

dren's study and involved them in extensive and vivid discussions. The purpose of the discussion was to help children realize the complexity of environmental issues, their global and controversial character, and their national and local relevance in an attempt to correctly conceptualise environmental degradation and the individual responsibility for the creation and/or the solution of these problems. In a final review session, student teachers and each group of children attempted to wrap up their experiences, and children were involved in new discussions where they could express their new understandings and feelings about the environmental issues they examined. There was a deliberate attempt to emphasize personal responsibility and active participation for adopting sustainable ways of living.

Data Collection

The present study was a part of a multifaceted project that examined the impacts of the out-door program to primary school children and university students. Qualitative and quantitative approaches for collecting data (personal reports, questionnaires, and observations) were used. Four university students were trained to conduct observations during the activities with children and administered all the questionnaires to the primary school children. For the purpose of the present study, the personal reports submitted at the end of the project by the participating student teachers constitute the only source of data. The personal reports were based on specific questions that asked them to describe whether and how their pre-service education tapped on specific environmental issues or whether they attended specific environmental courses. Student teachers were also asked to mention specific examples from the outdoor program that affected their knowledge about environmental issues and their responsibility to be involved in ESD. Finally, student teachers were prompted to describe how the outdoor program promoted their competence to deal with ESD in terms of designing specific teaching activities, or in terms of transferring knowledge and strategies from the outdoor program to their indoor teaching.

Results and Discussion

Student Teachers' Previous Experiences in Environmental Issues

Student teachers' reports indicated that they had several opportunities to study environmental issues through several courses, but these courses were not closely related to ESD. These courses focused rather exclusively on biology, ecology, and geography. Student teachers also mentioned that their experiences with environmental issues were restricted to acquiring academic knowledge and did not have any practical orientation. Some indicative examples of student teachers' responses are as follows:

My previous experience with environmental issues was through courses not directly connected with Sustainable Issues. It was the first time that I had the opportunity to participate in a training program like that. (Student 3)

Our pre-service education does not include any particular course or subject for Environmental Education or Education for Sustainable Development. So far, the only experiences that I had related to environmental issues were through a course, where we were visiting the forest near the university once a week to conduct observations on the web-food and on the ways that various organisms survive. (Student 5)

I had the chance to attend two courses that deal with environmental issues, but these focused on academic knowledge related to environmental issues, such as, acid rain, green house effect, ozone layer, etc. These courses are very informative and descriptive, but without any practical orientation. I did not have any opportunity to learn about methods of teaching and pedagogical approaches addressing these issues in primary schools. (Student 6)

My opinion about the environmental courses that I attended is that they were closely related to the subjects of biology, ecology, and geography. I attended two courses connected with environmental issues that pointed to the environment, but there was no

reference to any societal, political and economical aspects connected to the environment. (Student 10)

These descriptions seem to indicate that environmental issues were connected with specific subjects rather than being infused in the whole program of teacher preparation. The courses addressing environmental issues were targeting knowledge of the biophysical environment and seemed to be mono-dimensional. The social, political, and economical aspects of the environment that are closely interconnected with the biophysical environment and point to a holistic investigation of environmental issues were not included in student teachers' pre-service education. Brinkman and Scott (1994) supported that environmental issues are by definition interdisciplinary and action-oriented, and that these should be included in more than one subject areas. Nevertheless, environmental issues in the pre-service education of primary student teachers are rather separate modules connected with biology and ecology, or possibly with other subject areas as well. Several studies indicated that only students from the departments of environmental studies, biology, ecology and forestry are acquainted with environmental issues, while students from educational departments usually graduate without attending any special programs related to environmental education (Tikka, Kuithnen, & Tynys, 2000; Kaplowitz & Levine, 2005; Heck, 2005). It seems that environmental courses in education departments are usually an exception and not the rule (Powers, 2004).

Student teachers reported that through their studies, they studied mainly issues as acid rain, green house effect, and ozone layer. Key issues of ESD, such as poverty alleviation, citizenship, peace democracy, governance, gender equity, and cultural diversity (UNESCO, 2004) are not examined during their pre-service education. Several student teachers also reported that their previous experience did not tap on teaching methods that would allow them to work with these environmental issues. Hopkins (2002) stated that there is a large gap "between the recognition of the need for education's contribution and the reality of its actual delivery" (p. 1). Similarly, other researchers stated that teachers do not feel competent for promoting ESD in their school, because of deficiencies in their pre-service education (Wilke, 1985, Gabriel, 1996).

University Students' Environmental Knowledge and Environmental Responsibility

Students' reports indicated that the training program helped them to improve their knowledge for environmental issues and correctly conceptualize the systemic and holistic character of environmental issues. The program activities helped student teachers to realise that environmental issues are not only those connected with the natural dimension of the environment, but also those that have social, political, and economic implications as well. Student teachers also clarified the holistic and systemic character of sustainable development, as the following excerpts from their own reports indicate:

The program helped me to understand the systemic and holistic character of the environment and to also realise the multifaceted aspects of environmental issues. Prior to my participation in this program, I thought that environmental issues were mainly related to marine pollution, energy crises, forest destruction, and biodiversity ... through the program, I learned that poverty, social discrimination, human rights,

migration, and violence are also part of environmental issues ... [they are] the social, political and economical aspects of the environment (Student 9).

... I learned how the developing countries exploit natural resources from the third world countries, how the exhaustion of natural resources leads to a world wide economy crisis (Student 12).

... I couldn't understand what is sustainable tourism, and I couldn't understand the importance of retaining our local products ... when I saw the photos related to Cyprus and the impacts of tourism on my country, then I realised how important is to conserve our traditions, culture, and environment (Student 4).

Sustainable Development was an abstract concept for me ... during my participation in the program, I learned not only what does it mean, but I also understood that is a concept that has a lot of dimensions and could be applied to all aspects of our life (Student 15).

It seems that the training program helped student teachers to understand the overall intent of sustainable development that is based on the 'harmonious inter-relationship of the economy, the society, and the environment' (CEE, 1998, p. 2). The concept of sustainable development is considered complex and questionable (Sauve, 1996; Scott & Reid, 2001). It is thus encouraging to realize that the outdoor program help students to at least identify the multiple dimensions of sustainable development. Student teachers' engagement in various issues of social character (poverty, social discriminations, migration, human rights, tourism, violence, etc) seems that helped them to identify their interconnections, their impact on the quality of life, and the importance of living in a more sustainable manner. They also expressed ideas indicating that the program help them to go beyond the stage of preserving the natural environment and reducing human impacts on it, and devote efforts for improving the quality of life in terms of society and economy (McKeown & Hopkins, 2003). Taking into consideration that one main problem for integrating ESD in teacher pre-service education relates to its' multiple and manifold content (Plevyak, Bedixen-Noe, Roth & Wilke, 2001), similar programs, like the present one, pave the way for introducing sustainability issues.

Some teacher students stated that the program offered the participants the opportunity to connect global issues to local reality, and one of them stated that:

We worked with photos from all over the world ... [I] realised that the global issues are not restricted in some areas ... when I saw the photo of flood in Bangladesh, I really conceptualised and transformed this problem to the local level. I searched for the impact of flood in Bangladesh on my country (Student 4).

The connection of a global issue to local circumstances seemed to motivate students for an in-depth investigation of the interconnection and impact of similar issues on the whole environment and on humans. Hopkins, Damlamian and Lopez-Ospina (1996) stated that the connection of global issues with the local reality constitutes a very important step in the pedagogy of ESD.

ESD also targets the cultivation of people's commitment to take actions that contribute to a more sustainable future (Strauss, 1996). Through the program, students seemed to have acquired an increased sense of personal responsibility, not only as humans but also as professionals. Several student teachers stated that their involvement in the program increased their sense of personal responsibility, and

they felt ready not only to inform the wider community (fellows, parents, citizens) about the environmental degradation, but also to act at a personal level towards the preservation of the environment and the improvement of the quality of life in their communities.

My participation in the program made me feel responsible for informing my parents, my friends, and other people about all the environmental information that I acquired, in order to make them aware and start jointly working for improving our quality of life (Student 7).

I understand now the environment as a value ...the photos of poverty in Rio de Janeiro, the refugees' camp, the children mortality in the third world countries, and the environmental refugees made me feel that I must do something for that (Student 3).

Through my studies, I didn't have the opportunity to have an in-depth learning in environmental issues. Most of the time, we were talking in general about environmental issues and in a way that I couldn't understand my contribution to the preservation of environment and improvement of the quality of life. Through my active participation in the program, my interaction with my fellow students and with children, I realised that the environmental degradation starts from our way of living. This prompted me to investigate how my behaviour impacts on the environment, and how this [behaviour] could be changed for the well being of society (Student 8).

These excerpts from students' reports clearly indicate that the program increased the participants' sense of social awareness. Emotional engagement and active involvement in the issues of sustainability, which are almost always controversial, constitute powerful factors that contribute towards increased personal responsibility (Ballantyne, Fien, & Packer, 2001; Rickinson, 2000; Ballantyne & Packer, 2005).

Several student teachers described that the program empowered them as professionals to undertake action and work for sustainability. From the point of view of one of them, the program helped students realise the importance of their role as future teachers.

The program motivated me as a future teacher ...helped me to understand the importance of my role for making my students aware ..., it was the first time that I felt responsible for the environmental degradation (Student 5).

The responsibility that students as future teachers felt for promoting sustainable issues in school seems to be connected to their personal involvement in the design and implementation of several activities and teaching approaches for the primary school children. Likewise, Lagerweij and Lagerweij-Voogt (2004) (as cited in Van Petegem et al., 2005) stated that motivation and involvement in ESD are important factors for promoting ESD.

Student Teachers' Competence to Work for SD

Student teachers' reports also stated that the training program promoted their active involvement in designing and implementing appropriate teaching procedures. Several students mentioned that the program offered them the opportunity to be actively involved in planning relevant activities, and their statements indicated that the program enhanced their teaching and pedagogical approaches for effectively handling sustainable issues as future teachers.

It was an amazing educational experience... I learned how to organize my teaching outside the school, to designate clear tasks, and try to achieve them through various types of outdoor activities and educational approaches (Student 6).

The program functioned as an experiential educational tool that offered me the opportunity to learn how, as a future teacher, I can establish in my class conditions that will motivate my students to think critically and contribute both as individuals and in social groups to the implementation of sustainable societies (Student 3).

The program was useful for obtaining ideas and pedagogical methods for teaching issues of sustainability in school ... I understood how theory translates into practice, and how global issues through the proper activities and teaching could be connected to local issues (Student 8).

The program 'open my eyes' and widen my pedagogical horizons. Through this, I had, for the first time, the opportunity to teach outside the classroom and the school setting (Student 5).

It seems that the training program provided opportunities for improving student teachers' self-efficacy and competence to be involved in ESD. They mentioned in their reports that the program functioned as an experiential tool that guided them how to better organize their teaching, to set objectives and accomplish them using various outdoor activities and educational approaches. Student teachers' reports indicated that their participation in the program was an amazing experience that fostered their willingness and motivation to be involved in similar activities in the future. Similarly, Pekrun (1992) stated that interest for a topic or task could foster increased attention, greater concentration, and an increased willingness to be involved in similar activities.

Students also stated that their participation in the program helped them to combine theory and practice, while they designed and implemented pedagogical methods that could easily be used in indoor learning activities. Winter, Volk, and Schrock (2002) mentioned that teachers need to feel comfortable in the process of developing new approaches, and Fullan (1994) pointed out that self-esteem could be built through experience and mastery of learning objectives

The program seemed to help students to design and implement several activities that could be used both in non-formal and formal educational settings. Two student teachers reported that the program offered them the opportunities to transfer non-formal learning procedures to the school setting based on their outdoor activities.

I had the opportunity not only to overcome the traditional way of organizing my teaching, but also to investigate about several ways, activities, and teaching skills that I could apply afterwards in the school setting (Student 7).

Through my participation in the program, I gained experiences that would allow me to take initiatives for teaching environmental issues in and out of the classroom setting ... the program gave me outdoor experiences that made me feel more confident for working with children towards sustainability (Student 11).

The combination of formal and non-formal education is a substantial issue for ESD considering that a mixture of them can act as a catalyst for long-lasting effects, in terms of participants' behaviour and attitudes towards the environment and sustainable living. Other studies in non-formal educational settings indicated positive

effects both for participants' learning, and for their behaviour and attitudes towards sustainable development (Ballantyne & Uzell, 1994; Adelman, Falk, & James, 2000; Rickinson, 2001). There are not however studies that examined long lasting effects transferable beyond the learning setting, because these studies did not design any follow up activities in formal educational settings.

Many students mentioned in their reports that the program helped them to design and apply innovative pedagogical activities targeting critical thinking, re-creative, interactive and experiential learning. The program helped the students to use the outdoor environment as a place for acquiring educational experiences that are necessary for motivating students in sustainable actions.

...I interacted and discussed with the primary students. I learnt with them and through them. I realised how important is to design and implement cooperative learning strategies...[primary students'] reactions inspired me to organize new activities based on critical thinking, inquiring, autonomous re-creative learning (Student 13).

The program improved my teaching expertise. I designed activities based on a student-centred and problem-solving approach, and tailored to the needs of the students. Through the program, I realised that is important to tailor my teaching to the learning styles and the needs of my students, so that my teaching becomes more effective (Student 9).

I had the opportunity to implement activities based on role-play, visualization, concept maps ...I saw the reactions, the enthusiasm, and the active participation of children. It was my reward for my participation in the program (Student 14).

I learned how to organize my teaching outside the school setting, to clarify my tasks, and try to implement them through various types of outdoor activities and educational approaches (Student 6).

It seems that the program adequately addressed the needs of the pedagogy for ESD. Several studies identified teaching and learning in outdoor settings, teaching practices, and modelling as important techniques for teachers' training. Critical thinking, participation, and active learning are central concepts in ESD (Jickling, 1992; Benn, 1999; Bjorneloo, 2004; Summers, Childs & Corney, 2005). Similarly, the "Strategy for Education for Sustainable Development" (UNESCO, 2004) indicated that the "use of participatory processes and solution-oriented educational methods tailored to the learner" (p. 6) is very important and effective approach for teacher training.

All the steps of the training program were based on teamwork and encouraged the cooperation between university students and their mentor, amongst university students, and among university students and primary school children. The results indicated that the net of collaborations that were developed amongst the participants was a crucial factor for improving student teachers' teaching abilities and strategies.

We were following the guidelines of our mentor. I was collaborating with my classmates in all the phases of the planning and during its implementation. We were a team. I was part of a team. I had an active engagement and, through my team, I could express my opinions, receive feedback, and review many things in order to improve my teaching ability. This made me feel secure and, more importantly, committed to, because we were working as a team for something better (Student 5).

Brinkman and Scott (1994) supported that multilevel nets of collaboration usually enhance participants' commitment and reflection capacities, and encourage them to integrate the experience into their own professional development. This is considered an important variable for improving students' competence to work for ESD, because 'the most difficult constraint seems to be the motivation of all students to work as a team' (Van Petegem et al., 2005, p. 168).

The training program conveyed the interdisciplinary nature of environmental issues, and two student teachers stated that they studied topics not only from the natural sciences, but also from social sciences and humanities. They expressed the opinion that the program helped them to realise that every curriculum subject can contribute to a holistic inquiry of sustainable issues. They also recognized that humanities and social sciences could contribute to promoting children's environmental consciousness.

... We used history, language lessons, art, citizenship education, and health education in order to examine different environmental issues ... I realised that all the subject areas of the curriculum can contribute to an effective and holistic inquiry of sustainable issues (Student 4).

Until now, my approach was closely connected with the science lessons ... the program helped me to realise that humanities and social sciences can play a crucial role in developing students' environmental consciousness (Student 10).

The program offered the opportunity to student teachers to use various topics from the primary school curriculum in order to investigate environmental issues. They did not consider environmental education as an isolated and occasional topic among the boundaries of specific subjects. They learned how each subject can contribute to a holistic investigation of sustainable issues, and also realised that ESD is a matter of interdisciplinary learning.

Conclusions

The outdoor program was an alternative activity associated with a science methods course for science teaching. The results indicate that environmental issues in primary pre-service education in Cyprus are rather associated with biology, geography, and natural sciences in general. Student teachers' previous experiences were restricted to the investigation of natural ecosystems and neglected the integration of economy, society, and environment that consist the three dimensions of Sustainable Development (IES, 1999; Gough, 2002).

Students in educational departments are prospective teachers and have a special responsibility, to help their students to construct appropriate knowledge relating to environmental issues, to motivate and inspire their students for adapting sustainable models of behaviour. From this prospective, their present pre-service education does not seem to adequately integrate economy, society, and the environment. Mckeown (2000) examined the teachers' pre-service education in terms of Environmental Education and identified that prospective teachers have limited involvement in practical experience or outdoor activities, and limited engagement in pedagogical approaches and methods for teaching environmental issues effectively.

The collected evidence from the present outdoor program seems to suggest

that it enhanced student teachers' knowledge for sustainable issues and sustainable development. Student teachers' active involvement in all the phases of the outdoor program helped them to acquire a sound understanding of the concept of sustainable development, and to realise the complexities and the interconnections of relevant issues. They also improved their ability to treat environment as a system, and clearly understood the impact of their personal decisions and ways of behaving on the environment. Particularly, the program developed student teachers' personal and professional responsibility towards sustainable issue, and they felt committed as humans and as professionals to care and take actions for improving the quality of life in their social environment. They also realised that caring for the environment is not a matter of only teaching about it, but rather an active participatory process. ESD depends on teachers that are familiar with the pedagogical approaches that promote teamwork and cooperative learning activities (Benn, 1999; Second Nature, 1999). The program also provided an opportunity to a small number of student teachers to be involved in outdoor activities that can enrich their indoor teaching pedagogy and practices. Ballantyne and Packer (2005) argued that "informal educational environments provide important opportunities for the promotion of environmentally sustainable attitudes and behaviours, ... allow learners to engage with and in the environment, to observe the evidence ... and to explore and construct their environmental knowledge, skills attitudes, beliefs and behaviours, in personally relevant and meaningful ways" (p. 290).

The program also provided student teachers the opportunity to organize activities tailored to the needs of their students and think about ways to connect the activities to the local reality. Similar programs can be easily applied and constitute action-oriented education. Student teachers realised that this kind of open and innovative programs can also influence their students' behaviours and promote ideas compatible with sustainable development and more sustainable ways of living.

Nevertheless, the small sample of the study and its limited duration do not allow for any final conclusions. The available evidence points to very positive results, but there is no evidence supporting long-lasting implications on prospective teachers' professional and personal commitment to invest time and efforts supporting ESD. The cumulative evidence supports however the inclusion of outdoor activities in the pre-service education programs of teachers. Despite the positive outcomes of the outdoor program, there is no basis to support that there will be significant impact on their professional activities targeting ESD.

Implementing ESD entails teachers who are open-minded and not reluctant to be involved in innovative pedagogical and teaching procedures. Universities play a crucial role by preparing future teachers and other professionals that should take initiatives and actions supporting sustainable development and ways of living aligned to sustainability. There is a need for 're-culturing' teacher programmes, so as future teachers see the benefits and possibilities of ESD, and adapt effective practices showing how ESD could be integrated in daily instruction (West 2000, Van Petegem et al., 2005).

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